

Claims

What is claimed is:

1. An optical identification element attached to a chemical, comprising:
 - 5 an optical substrate;
 - at least a portion of said substrate having at least one diffraction grating disposed therein, said grating having at least one refractive index pitch superimposed at a common location;
 - 10 the grating providing an output optical signal when illuminated by an incident light signal;
 - 15 said optical output signal being indicative of a code in said substrate; and the chemical being attached to said substrate.
2. The apparatus of claim 1 wherein said substrate is made of a glass material.
3. The apparatus of claim 1 wherein said code comprises a plurality of bits.
4. The apparatus of claim 1 wherein the number of pitches is indicative of the number of said bits in said code.
- 20 5. The apparatus of claim 1 wherein said substrate has a length that is less than about 500 microns.
6. The apparatus of claim 1 wherein said substrate has a cylindrical shape.
7. The apparatus of claim 1 wherein said grating is a blazed grating.
- 25 8. The apparatus of claim 1 wherein said code comprises a plurality of bits, each bit having a plurality of states.
9. The apparatus of claim 1 wherein said substrate has a reflective coating disposed thereon.

10. The apparatus of claim 1 wherein said substrate is has a magnetic or electric charge polarization.

11. The apparatus of claim 1 wherein said substrate has a grating region where said grating and a non-grating region where said grating is not located; and 5 wherein said substrate has a plurality of grating regions.

12. The apparatus of claim 1 wherein said substrate has geometry having holes therein.

13. The apparatus of claim 1 wherein said substrate is has a geometry having protruding sections.

10 14. The apparatus of claim 1 wherein at least a portion of said substrate is has an end cross sectional geometry selected from the group: circular, square, rectangular, elliptical, clam-shell, D-shaped, and polygon

15 15. The apparatus of claim 1 wherein at least a portion of said substrate is has a side view geometry selected from the group: circular, square, rectangular, elliptical, clam-shell, D-shaped, and polygon.

16. The apparatus of claim 1 wherein at least a portion of said substrate is has a 3-D shape selected from the group: sphere, a cube, a pyramid.

20 17. The apparatus of claim 1 wherein said code comprises at least a predetermined number of bits, said number being: 3, 5, 7, 9, 10, 12, 14, 16, 18, 20, 24, 28, 30, 40, 50, or 100.

25 18. A microparticle attached to a chemical comprising:
an optical substrate;
at least a portion of said substrate having at least one diffraction grating disposed therein, said grating having at least one refractive index pitch superimposed at a common location;
the grating providing an output optical signal when illuminated by an incident light signal;

said optical output signal being indicative of a code in said substrate; and
the chemical being attached to said substrate.

19. A method of synthesizing a chemical on an optical element, comprising:

obtaining a optical element, comprising:

an optical substrate;

5 at least a portion of the substrate having at least one diffraction grating disposed therein,

the grating having at least one refractive index pitch superimposed at a common location;

10 the grating providing an output optical signal when illuminated by an incident light signal; and

the optical output signal being indicative of a code; and
attaching a chemical to the element.

20. The apparatus of claim 1 wherein said element is made of a glass material.

15